Navy Advancement Center
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Advancement Handbook for Machinery Repairman

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PREFACE

The purpose of the Advancement Handbook is to help you focus your preparation for Navywide advancement-in-rating examinations. The bibliographies (BIBs) together with this handbook form a comprehensive examination study package. Since this handbook provides skill and knowledge components for each paygrade of the MR rating, it helps you concentrate your study on those areas that may be tested. This feature will help you get the most out of your study time.

Each page in Parts 1 through 4 of this Advancement Handbook presents general skill areas, specific skill areas, the knowledge factors associated with each skill area, the pertinent references that address each skill, and the subject areas that may be covered on the examination. The skill statements describe the skills you are expected to perform for each paygrade. The skill statements are cumulative; that is, you are responsible for the skills for the paygrade you are competing for, your present paygrade, and all paygrades below.

Although this handbook is very comprehensive, it cannot cover all the tasks performed in the rating. As a result, the advancement examinations may contain questions more detailed than described in the *"Exam Expectations"* section of the skill areas.

Remember that advancement competition is keen, so your keys to advancement include not only comprehensive advancement examination study but also sustained superior performance.

Prepared by
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Part 1

Advancement Handbook for MR3

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General MR3 *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Draft part for manufacturing and alteration working drawings**
Knowledge you should have to perform this skill:	• Identify the parts of a blueprint to include information they contain • Identify parts of machine drawing to include terms, symbols, and conventions • Recall American National Standards as used in engineering drawings • Identify projections and views
References you should study to gain the knowledge you need to perform this skill:	• Blueprint Reading and Sketching, chapters 1 through 4, NAVEDTRA 12014 • Machinery Repairman, chapter 2, NAVEDTRA 12204-A • Machinery's Handbook; Standards for Drawings
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the parts of a blueprint, including their location and use; the types and uses of line standards used in a machine drawing; the uses of different views and projections; and the meaning of terms and symbols used in machine drawings.

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General **MR3** *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Lay out geometric construction work**
Knowledge you should have to perform this skill:	• Recall methods used for technical sketching and mechanical drawing • Recall the methods used to lay out geometric construction work • Identify tools used for making layouts on metals • Perform basic math and trigonometric computations
References you should study to gain the knowledge you need to perform this skill:	• Blueprint Reading and Sketching, chapters 2 and 3, NAVEDTRA 12014, • Machinery Repairman, chapter 2, NAVEDTRA 12204-A • Mathematics, volume 1, chapters 17 through 19, NAVEDTRA 10069-D1, • Use and Care of Hand Tools and Measuring Tools, chapters 5, 6, 8, and 12, NAVEDTRA 12085
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the methods, terminology, and mathematical computations used to lay out bolt holes on valve flanges and on flat metals to include identification of various precision and nonprecision tools used for layout.

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General **MR3** *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Select metals or plastics needed to manufacture repair parts**
Knowledge you should have to perform this skill:	• Identify the properties of ferrous and nonferrous metals and plastics used to manufacture repair parts • Identify the composition of carbon and alloy steels and nonferrous metals used to manufacture repair parts • Identify the commercial and government designations of carbon and alloy steels and nonferrous metals • Identify the government designations of major groups of plastics
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 3, NAVEDTRA 12204-A • Machinery's Handbook; Standard Steels, Nonferrous alloys, Plastics • Ship Metallic Material Comparison and Use Guide, NAVSHIPS 0900-038-8010
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the properties, composition, designations, and identification of ferrous and nonferrous metals, ferrous and nonferrous alloys, and plastics.

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General **MR3** *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Make shop related mathematical computations**
Knowledge you should have to perform this skill:	• Recall the shop-related basic mathematical and trigonometric computations
References you should study to gain the knowledge you need to perform this skill:	• Mathematics, volume 1, chapters 1 through 9, 13, and 17 through 19, NAVEDTRA 10069-D1
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about computations used for feeds and speeds, tapers, bolt hole layout, thread dimensions, indexing, converting units of measurements, percentages, areas, volume and other machining related math.

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General **MR3** *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Select single point cutting tools and tool holders**
Knowledge you should have to perform this skill:	• Recall the purpose and use of single cutting tools and tool holders • Recall terminology • Recognize inserts and holders • Identify material designations, including inserts
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 5, NAVEDTRA 12204-A • Machinery's Handbook; Cutting tools, Carbide Tips and Tools, Cemented Carbides and Other Hard Materials, and Hard Metal Cutting Inserts
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the parts of a single point cutting tools, properties of different single point cutting materials, designations and identifications of cemented carbides and indexable inserts, application of various cutting tool materials to the kind of materials being machined.

General **MR3** *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Set up all inside machine shop machinery for various machining applications**
Knowledge you should have to perform this skill:	Identify the procedures for setting up the following inside machine shop machinery: • Milling machines • Lathes • Carbide tools and tool holders • Drilling machines • Engravers • Metal cutting saws • Metal disintegrators • Oxyacetylene equipment • Presses • Sandblast cabinets Identify the location and use of the sand-blasting machine working parts, attachments and accessories Recall the safety precautions for safe operation of machinery
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapters 4 through 7, 9, and 13, NAVEDTRA 12204-A • Manufacturer's technical manual
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the procedures used to operate the following machines: lathes, offhand grinding machines, milling, power saws, drills, engravers, and other inside machine shop equipment. You can also expect questions on applicable safety precautions.

General **MR3** *Skill Area*	**MACHINE OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform repairs on shipboard machinery components using applicable inside machine shop equipment**
Knowledge you should have to perform this skill:	• Recall procedures used to perform repairs on shipboard machinery components. • Recall the repair set up for shipboard machinery component • Recall applicable procedures for performing benchwork • Identify quality assurance procedures • Interpret readings as indicated on the precision instrument used. • Recall applicable safety precautions.
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapters 1 through 7, 9, and 13, NAVEDTRA 12014-A • NSTM, chapter 503, Pumps, pages 2-34 through 2-37, 3-19, 4-18 through 4-19, NAVSEA S9086-RH-STM-010 • Repair of Submarine Seawater Ball Valves, volume 1, chapter 3, Appendices A, B, and C, NAVSEA S-9520-AA-MMA-01-0 • Repair of Seawater Valves, Seat Cavities and O-ring Areas, Portsmouth Process Instruction Number, 4820-921-339 • Centrifugal Pump, chapters 9 and 14, NAVSEA S6225-AP-MMI-010 • Valves, Traps, and Orifices (Non Nuclear), pages 6-20 through 6-28, 6-57, 6-66 through 6-71, NAVSEA S9253-AD-MMM-010 • Joint Fleet Maintenance Manual, volume 5, Part 1, chapter 1; Part 11, chapters 1 through 5, and 7, CINCANTFLT/ CINCPACFLTINST 4790.3

Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about repair procedures on the following components: various types of pumps, valves, shafts, fasteners, gears, pipe flanges, bearing surfaces and other shipboard machinery components using applicable inside machine shop tools and machinery. You can also expect questions on applicable safety precautions.

General MR3 *Skill Area*	**MACHINE OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform various machining operations**
Knowledge you should have to perform this skill:	Identify the procedures to use when performing the following actions on lathes: • Turning • Facing • Threading • Parting and grooving • Drilling • Reaming • Boring • Knurling • Grinding Identify the procedures to use when performing the following actions on milling machines: • Drilling • Fly cutting • Boring • Reaming • Gearing • Indexing (plain, rapid and angular) • Slotting • Parting Identify the procedures to use when performing the following actions on drilling machines: • Drilling • Counterboring • Countersinking • Spotfacing • Tapping • Reaming Identify the procedures to use when performing the following actions on pedestal and bench grinders:

	• Offhand grinding Identify the procedures to use when performing the following actions on power hacksaws and continuous feed cut-off saws: • Cutting (straight, angular, contour, inside) • Filing • Polishing Recall applicable safety precautions.
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapters 2,and 4 through 7, NAVEDTRA 12204-A • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about all applicable operations on lathes, mills, grinders, power saws, drills and other inside machine shop machinery to include applicable safety precautions.

General MR3 *Skill Area*	**FABRICATION AND MANUFACTURING**
A *skill* you are expected to perform from the General Skill Area above:	**Manufacture various shipboard machinery and nonmachinery parts**
Knowledge you should have to perform this skill:	• Identify the procedures used to manufacture parts using inside shop machinery • Recall applicable safety precautions • Recall quality assurance procedures
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapters 1 through 7, 9, and 13, NAVEDTRA 12204-A • Joint Fleet Maintenance Manual, volume 5, Part 1, chapter 1; Part 11, chapters 1 through 5 and 7 CINCLANTFLT/ CINPACFLTINST 4790.3 • Blueprint Reading and Sketching, chapters 1 through 4, NAVEDTRA 12014,
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about machine operations for the manufacture of machinery and nonmachinery parts to include applicable safety precautions. You can also expect questions about quality assurance procedures when manufacturing various machinery and nonmachinery parts. You can also expect questions about interpreting detailed drawings.

General MR3 *Skill Area*	**ENGRAVING**
A *skill* you are expected to perform from the General Skill Area above:	**Set up and operate automated and nonautomated engraving machines**
Knowledge you should have to perform this skill:	• Identify the major components of an engraving machine to include the attachments • Recall the set up of engraving machines for grinding engraving cutters • Recall the set up of engraving machines to set the feeds and speeds of the cutter for different materials of various sizes • Recall applicable safety precautions
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 9, NAVEDTRA 12204 • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the components and applicable attachments of a pantograph, grinding engraving cutters, feeds, and speed of cutters when engraving on different materials. You can also expect questions about applicable safety precautions.

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General MR3 *Skill Area*	**METALS AND PLASTICS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform rapid and general identification tests on metals and plastics**
Knowledge you should have to perform this skill:	• Identify the characteristics of common machine shop metals and plastics • Identify the results of the magnetic tests, chip tests, and file hardness tests used on metals • Identify markings found on metals and plastics
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 3, NAVEDTRA 12204-A • Metal Comparison Guide, NAVSHIPS 0900-038-8010
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the characteristics of metals and plastics, the results of various methods of metal testing, and the designation, and markings of metals and plastics.

General MR3 *Skill Area*	**SHOP OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform precision measurements**
Knowledge you should have to perform this skill:	• Identify the parts of various precision-measuring instruments • Identify the function of various precision-measuring instruments • Recognize indicated measurements on various precision-measuring instruments
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 1, NAVEDTRA 12204-A • Use and Care of Hand Tools and Measuring Tools, chapters 6, 7, 14, 15, and 16, NAVEDTRA 12085, • Machinery's Handbook; Measuring Instruments and Inspection Methods
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the parts and uses of micrometers, vernier calipers, bevel protractors, gauges and other machine shop precision-measuring instruments. You can also expect questions about interpreting the results of machine shop precision-measuring instruments. You can also expect questions about the interpretations of these measurements

General MR3 *Skill Area*	**SHOP OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform various benchwork operations**
Knowledge you should have to perform this skill:	Recall the tools and procedures used for the following benchwork operations: • Hand scraping • Bluing • Filing • Hand sawing • Lapping • Broaching • Chipping • Hand tapping • Hand drilling Recall the applicable safety precautions.
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 2, NAVEDTRA 12204-A • Use and Care of Hand Tools and Measuring Tools, chapters 20, 24 through, 28, 38, 39, and 52, NAVEDTRA 12085
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the procedures when performing the following benchwork operations: hand scraping, bluing, filing, hand sawing, lapping, broaching, chipping, hand tapping, and hand drilling. You can also expect questions about applicable tools and applicable safety precautions.

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General MR3 *Skill Area*	**SHOP OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform offhand grinding of metal cutting tools**
Knowledge you should have to perform this skill:	• Identify the parts of single-point cutters and drill bits • Identify the procedures used to perform offhand grinding • Recall applicable safety precautions
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 5, NAVEDTRA 12204-A • Machinery's Handbook; Cutting Tools
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the terminology, definitions, and purposes of the different parts of single-point cutting tools. You can also expect questions about sharpening procedures, cutting effects as ground to a certain specification, and the application of different types of single-point cutting tools and drill bits to include safety precautions.

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General MR3 *Skill Area*	**MACHINE OPERATION**
A *skill* you are expected to perform from the General Skill Area above:	**Issue tools**
Knowledge you should have to perform this skill:	• Recognize toolroom organization and safety • Recognize the process used to issue tools • Identify the controlled equipage in a machine shop
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 1, NAVEDTRA 12204-A • Use and Care of Hand Tools and Measuring Tools, chapters 2, 5 through, 9, 12 through 16, 19 through 21, 24 through 29, 35, 38, 39, 41 and 52, NAVEDTRA 12085
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the uses of precision and nonprecision measuring instruments, gauges, standards, and hand and power tools. You can also expect questions about the organization of tools in the toolroom including the issue of controlled and noncontrolled tools and safety.

General MR3 *Skill Area*	**SHOP OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Determine the quality of machine finished surfaces**
Knowledge you should have to perform this skill:	• Identify symbols used to identify surface finishes • Identify the characteristics of surface finishes • Recall the comparison method of determining surface finishes • Recall the other methods used to determine surface finishes.
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 2, NAVEDTRA 12204-A • Blueprint Reading and Sketching, chapter 4, NAVEDTRA 12014
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the surface characteristics of machined metals and the symbols for machined surfaces, the procedures for visual inspection and the comparison method used to determine surface finishes.

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General MR3 *Skill Area*	**MECHANICAL MAINTENANCE**
A *skill* you are expected to perform from the General Skill Area above:	**Perform maintenance on and precision and nonprecision measuring instruments**
Knowledge you should have to perform this skill:	• Identify the procedures to perform maintenance on precision and nonprecision measuring instruments • Recall applicable safety precautions.
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 2, NAVEDTRA 12204-A • Use and Care of Hand Tools and Measuring Tools, chapters 5 through 9, 14, 15, and 16, NAVEDTRA 12085, • Machinery's Handbook; Measuring Instruments and Inspection Methods • Manufacturer's technical manual
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about inspecting, testing, adjusting, lubricating, cleaning, storing, and verifying the accuracy of precision and nonprecision measuring instruments. You can also expect questions about applicable safety precautions.

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General MR3 *Skill Area*	**MECHANICAL MAINTENANCE**
A *skill* you are expected to perform from the General Skill Area above:	**Perform maintenance on shop equipment**
Knowledge you should have to perform this skill:	• Identify the procedures to use to perform maintenance on shop equipment • Recall applicable safety precautions • Identify the 3-M program • Identify PMS
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapters 4 through ,7 and 9, NAVEDTRA 12204-A • Ships'Maintenance and Material Management (3-M) Manual, chapter 3, OPNAVINST 4790.4 • Manufacturer's technical manual
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about testing, adjusting, inspecting, cleaning, and lubricating shop equipment to include applicable safety precautions. You can also expect questions about the ship's 3-M program and PMS.

General MR3 *Skill Area*	**TECHNICAL ADMINISTRATION**
A *skill* you are expected to perform from the General Skill Area above:	**Research technical publications for job specifications**
Knowledge you should have to perform this skill:	• Recall parts of a blueprint. • Recall information on ship's index drawing and ship's technical library.
References you should study to gain the knowledge you need to perform this skill:	• Blueprint Reading and Sketching, chapters 1 through 4, NAVEDTRA 12014 • Ship's Drawing Index (ship specific) • Joint Fleet Maintenance Manual, volume 4, Part 1, chapter 22, CINCLANTFLT/ CINCPACFLTINST 4790.3
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the parts of a blueprint and the procedures to use when retrieving a detail drawing from a plan drawing.

Part 2

Advancement Handbook for MR2

Advancement Handbook for MR2

General MR2 *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform compound and differential indexing**
Knowledge you should have to perform this skill:	• Recall the parts of indexing equipment, to include accessories and their uses • Identify the procedures used for rapid and plain indexing • Identify the procedures used to set up the gear train • Recall basic mathematics
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 7, NAVEDTRA 12204-A • Machinery's Handbook; Simple, Compound, Differential, and Block Indexing • Mathematics, volume 1, chapters.4 and 5, NAVEDTRA 10069-D1
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the uses of indexing equipment; the calculations and methods of compound and differential indexing; and calculations of gear ratios.

General MR3 *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Set up precision grinding equipment and attachments for various machining applications**
Knowledge you should have to perform this skill:	• Identify the locations and uses of the working parts of precision grinding equipment and attachments • Recall the set up procedures for each piece of precision grinding equipment • Recall the procedures used for static balancing a grinding wheel • Recall applicable safety precautions for machine operations
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 10, NAVEDTRA 12204-A • Manufacturer's technical and operations manual
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the parts, location of parts, functions of the working parts, and attachments of the following precision grinding machines: surface grinders, tool and cutter grinders, cylindrical grinders, and honing machines. You can also expect questions about the procedures in static balancing a grinding wheel. You can also expect questions about safety precautions to follow when using precision grinding equipment.

General MR2 *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Set up metal build up repair equipment**
Knowledge you should have to perform this skill:	• Recognize electroplating safety equipment • Identify electroplating equipment • Identify plating solutions for a corresponding material • Recognize the procedures for electroplating anode selection and preparation • Identify thermal spray process safety equipment • Identify the process used for gas selection during the thermal spray process • Recognize wire oxygen-fuel gas spray and powder oxygen-fuel gas spray equipment and functions • Identify the coating materials for thermal repair applications
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 12, NAVEDTRA 12204-A • Brush Electroplating on Marine Machinery, MIL-STD-2197(SH) • Thermal Spray Processes for Naval Ship Machinery Application, MIL-STD-1687(SH)
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the uses of electroplating equipment, the kinds of anode and solutions used for different applications, the names and functions of thermal spray equipment, and types of metal coating and gases used for specific applications. You can also expect questions about applicable safety equipment and precautions.

General MR2 *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Set up heavy machinery machining equipment**
Knowledge you should have to perform this skill:	• Recall the procedures used to set up heavy machining equipment for various operations • Identify the name, location, and use of controls and working parts to include attachments and accessories for specific operations • Identify the applicable safety precautions
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapters 8 and 9, NAVEDTRA 12204-A • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the parts and their location on heavy machinery, functions of the working parts and attachments. You can also expect questions about the safety precautions when operating horizontal boring milling machines, planers, shapers, and vertical turret lathes.

General MR2 *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Set up heat-treating equipment and devices**
Knowledge you should have to perform this skill:	• Identify the types of heat-treating equipment and devices. • Recall procedures for setting up heat-treating devices and equipment: • Identify the heat-treating equipment controls • Recognize indicators for proper operation • Recall applicable safety precautions
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 15, NAVEDTRA 12204-A • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about types, names and functions of heat treatment ovens, soaking devices, and quenching/cooling devices to include their associated controls and indicators. You can also expect questions on applicable safety precautions.

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General MR2 *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Set up hardness testing equipment**
Knowledge you should have to perform this skill:	• Recall the functions of parts and accessories of a metal hardness tester
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 15, NAVEDTRA 12204-A • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the parts and functions of Rockwell, Brinell, and scleroscope testers.

General MR2 *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Set up portable valve repair equipment and attachments**
Knowledge you should have to perform this skill:	• Recall the functions of portable valve repair equipment to include parts and attachments • Identify applicable safety precautions
References you should study to gain the knowledge you need to perform this skill:	• Repair of Submarine Seawater Ball Valves, volume 1, chapter 3, NAVSEA S-9520-AA-MMA-01-0 • Maintenance Manual for Valves, Traps, and Orifices, volume 1, chapter 6, NAVSEA S9253-AD-MMM-010 • Machinery Repairman, chapter 13, NAVEDTRA 12204-A • Manufacturer's operating manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the types and functions of portable valve repair equipment to include applicable safety precautions.

General MR2 *Skill Area*	**PREMANUFACTURING PREPARATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Align and level lathe and milling machines**
Knowledge you should have to perform this skill:	• Recall the methods of aligning lathe and milling machines
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapters 6 and 7, NAVEDTRA 12204-A • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the methods of aligning and leveling lathes and milling machines.

General MR2 *Skill Area*	**MACHINING OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform metal build up repair using thermal spray method**
Knowledge you should have to perform this skill:	• Recall the restrictions and limitations or a thermal spray process • Identify the procedures for the surface preparation of components to be thermally sprayed • Identify the procedures used to apply thermal sprayed coatings • Identify the procedures for finished machining the coated surface • Identify applicable safety precautions
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 12, NAVEDTRA 12204-A • Thermal Spray Processes for Naval Ship Machinery Applications, MIL-STD-1687A(SH) • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the procedures used to prepare the surface, application of the metal coating, and machining of the excess metal deposits in a component to be repaired. You can also expect questions about restrictions, and limitations of a thermal spray repair procedure to include applicable safety precautions.

General MR2 *Skill Area*	**MACHINING OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform brush on contact electroplating**
Knowledge you should have to perform this skill:	• Recall machine operations used to perform brush on contact electroplating • Identify the electroplating solutions used on a specific base metal • Recall repair classifications to include detailed requirements when applying electroplating procedure • Identify quality assurance test requirements • Identify the restrictions and limitations of electroplating applications • Identify applicable safety precautions when performing electroplating to include the handling of electroplating solutions
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 12, NAVEDTRA 12204-A • Brush Electroplating on Marine Machinery, MIL-STD-2197(SH) • Manufacturer's electroplating manual
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the function of the operating components of an electroplating machine to include applicable safety precautions and identification of electroplating solutions used on a specific base metal. You can also expect questions about the classes of electroplating applications, restrictions and limitations, and the quality assurance test requirements on all electroplating jobs.

General MR2 *Skill Area*	**MACHINING OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform cutting tapers and other applicable machining operations using the vertical turret lathe**
Knowledge you should have to perform this skill:	• Recall the computations to use for set up the vertical turret late to cut taper • Recall various machining operations using the vertical turret lathe • Recall applicable safety precaution
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 8, NAVEDTRA 12204-A, • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the computations used for taper set up of a required angle on a vertical turret lathe. You can also expect questions about using the vertical turret lathe for machining operations to include applicable safety precautions.

General MR2 *Skill Area*	**MACHINING OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Set up and machine pump casing using the horizontal boring mill**
Knowledge you should have to perform this skill:	• Identify the operation of the horizontal boring mill to machine pump casings • Identify the attachments used to machine pump casings • Recall applicable safety precautions
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 8, NAVEDTRA 12204-A • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the working parts of a horizontal boring mill. You can also expect questions on the set up and operation of the horizontal boring mill to machine pump casings, including applicable safety precautions.

General MR2 *Skill Area*	**MACHINING OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Perform in-place repair using portable machining equipment**
Knowledge you should have to perform this skill:	• Identify the uses of various portable machining equipment • Identify the working parts and attachments of portable machining equipment • Recognize the procedures to used for in-place repairs using portable machining equipment • Recall applicable safety precautions.
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 13, NAVEDTRA 12204-A • Maintenance Manual for Valves, Traps, and Orifices (Non Nuclear), volume 1, chapter. 6, NAVSEA S9253-AD-MMM-010 • Repair of Submarine Seawater Ball Valves (Non Nuclear), volume. 1, Appendix D, NAVSEA S-9520-AA-MMA-01-0
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the parts and attachments of various portable machining equipment. You can also expect questions about repair procedures for various valves, and flanges to include applicable safety precautions.

General MR2 *Skill Area*	**FABRICATION AND MANUFACTURING**
A *skill* you are expected to perform from the General Skill Area above:	**Manufacture various types of machinery gears**
Knowledge you should have to perform this skill:	• Recognize terms and their application to gear manufacture • Identify the machine set up procedures for gear manufacture • Identify the mathematical formula used for calculating various gear elements and their dimensions • Identify the machining steps in manufacturing a specific type of gear • Recall applicable safety precautions
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 14, NAVEDTRA 12204-A • Machinery's Handbook; Gears and Gearing
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions on the manufacture of spur gear, helical gear, bevel gear, worm, worm gear and hob, stub tooth gear, splines, sprockets and gear rack to include definitions and terminology. You can also expect questions on machining set up, mathematical calculations, machining steps, and measurement of dimensions.

General MR2 *Skill Area*	**FABRICATION AND MANUFACTURING**
A *skill* you are expected to perform from the General Skill Area above:	**Manufacture/machine lube oil strainer plugs, gauge plugs and weight handling components**
Knowledge you should have to perform this skill:	• Recall blueprint interpretations; machining set up; and quality assurance procedures
References you should study to gain the knowledge you need to perform this skill:	• Blueprint Reading and Sketching, chapters 1 through 4, NAVEDTRA 12014 • Joint Fleet Maintenance Manual, volume 5, Part II, chapters 5, 8, and 11, CINCLANFLT/CINCPACFLTINST 4790.3
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about machining set up, manufacturing, and quality assurance.

General MR2 *Skill Area*	**ENGRAVING**
A *skill* you are expected to perform from the General Skill Area above:	**Perform precision engraving using attachments**
Knowledge you should have to perform this skill:	• Identify the attachments of a pantograph for engraving circular work, cylindrical work, and dial faces
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 9, NAVEDTRA 12204-A • Manufacturer's operating manual
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the set up of pantograph attachments to include copy dial holders, indexing attachments, forming guides, and rotary tables.

General MR2 *Skill Area*	**METALS AND PLASTICS**
A *skill* you are expected to perform from the General Skill Area above:	**Identify metals using spark and acid reaction tests**
Knowledge you should have to perform this skill:	• Recall the criteria used to identify metal by spark test: • Identify the length, color, and type of spark stream • Identify metal by observing its colored reaction to an acid test
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 3, NAVEDTRA 12204-A • Manufacturer's technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the different criteria used to identify metal through spark and acid reaction tests.

Advancement Handbook for MR2

General MR2 *Skill Area*	**METALS AND PLASTICS**
A *skill* you are expected to perform from the General Skill Area above:	**Determine metal hardness**
Knowledge you should have to perform this skill:	• Identify the procedures used to test metals using applicable hardness testers • Recognize the functions and applications of various types of metal hardness tester • Interpret the results of tests using a specific hardness tester
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 15, NAVEDTRA 12204-A • Machinery's Handbook; Testing the Hardness of Metal
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You will be asked questions about the use, operation, and evaluation of results using the Rockwell Hardness tester, Brinell Hardness tester, and Shore's Scleroscope Hardness tester.

General MR2 *Skill Area*	**METALS AND PLASTICS**
A *skill* you are expected to perform from the General Skill Area above:	**Identify metals and plastics using the Military Specifications Handbook and Federal Supply Catalog**
Knowledge you should have to perform this skill:	• Recall the AISI-SAE System of metal designation • Recall the federal or military designations of metals and plastics
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 3, NAVEDTRA 12204-A • Machinery's Handbook; Numbering Systems, Standard Steels, Non-ferrous Alloys, Plastics • Ship Metallic Material Comparison and Use Guide, NAVSHIPS 0900-038-8010
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the AISI/SAE, government, and commercial specifications of metals and plastics, to include their corresponding common name.

Advancement Handbook for MR2

General MR2 *Skill Area*	**SHOP OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Heat-treat metals to desired specification**
Knowledge you should have to perform this skill:	• Recall basic metallurgy • Recall the principles of heat treatment • Identify the process used in heat treatment • Identify problems that occur during heat treatment • Recall the solutions of heat treatment problems
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 15, NAVEDTRA 12204-A • Machinery's Handbook; Heat Treatment of Standard Steel and Non-ferrous Alloys • Ship Metallic Material Comparison and Use Guide, NAVSHIPS 0900-038-8010
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about basic metallurgy, the principles and processes of heat treating ferrous and nonferrous metals and the problems and solutions of heat treating metals.

General MR2 *Skill Area*	**SHOP OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Determine machined surface quality**
Knowledge you should have to perform this skill:	• Recognize various instruments used to measure surface irregularities of machined surfaces • Recall the controls and functions of various surface finish analyzers
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 2, NAVEDTRA 12204-A • Machinery's Handbook; Surface Texture • Machine technical manuals
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the use and functions of interference microscope, profilometer, surface analyzer, and other methods of determining the quality of a machined surface finish. You can also expect questions about the different symbols use to indicate and identify machined finish surfaces.

General MR2 *Skill Area*	**SHOP OPERATIONS**
A *skill* you are expected to perform from the General Skill Area above:	**Identify and store controlled materials**
Knowledge you should have to perform this skill:	• Recognize the methods used to identify, inspect, document, handle, issue, and store controlled materials
References you should study to gain the knowledge you need to perform this skill:	• Joint Fleet Maintenance Manual, Part 11, chapter V, CINCLANTFLT/ CINCPACFLTINST 4790.3
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about controlled material based on the following knowledge: determination, procurement, receipt inspection, markings, storage, issue and handling

General MR2 *Skill Area*	**PUMPS AND VALVES**
A *skill* you are expected to perform from the General Skill Area above:	**Inspect/repair/replace components of pumps and valves**
Knowledge you should have to perform this skill:	• Recognize the parts and functions of valves and pumps • Recall the repair procedures of valves and pumps • Recall applicable safety precautions
References you should study to gain the knowledge you need to perform this skill:	• Maintenance Manual for Valves, Traps, and Orifices, Volume 1, chapter 6, NAVSEA S9253-AD-MM-010 • NSTM, chapter 503, Pumps, NAVSEA S9086-RH-STM-10 • Machinery Repairman, chapter 13 NAVEDTRA 12204-A • Description and Repair of Centrifugal Pumps, chapters 9 and 14, NAVSEA S6225-AP-MM1-010,
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about repairing and replacing wearing parts of pumps and disk, seat, stems, and shims for valves. You can also expect questions about applicable safety precautions.

Advancement Handbook for MR2

General MR2 *Skill Area*	**PUMPS AND VALVES**
A *skill* you are expected to perform from the General Skill Area above:	**Adjust and align pump shaft**
Knowledge you should have to perform this skill:	• Recognize the procedures in aligning pump and motor shafts
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapter 13, NAVEDTRA 12204-A • NSTM, chapter 503, Pumps, NAVSEA S9086-RH-STM-010, • Description and Repair of Centrifugal Pumps, chapter 9, NAVSEA S6225-AP-MM1-010
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the procedures used to align pump and motor shafts.

General MR2 *Skill Area*	**TECHNICAL ADMINISTRATION**
A *skill* you are expected to perform from the General Skill Area above:	**Maintain precision measuring instruments calibration log**
Knowledge you should have to perform this skill:	• Recall the use of calibration labels and tags • Identify the procedures used to maintain a machine shop's precision measuring instruments log
References you should study to gain the knowledge you need to perform this skill:	• Metrology and Calibration Laboratory Requirements and Certification Guide, chapter 6, NAVSEA ST700-AM-GYD-010/METCAL, • Calibration and Measurements Requirements, MIL-STD-1839
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about identifying calibration labels and tags. You can also expect questions about the procedures used to maintain a precision measuring instruments calibration log.

General MR2 *Skill Area*	**TECHNICAL ADMINISTRATION**
A *skill* you are expected to perform from the General Skill Area above:	**Analyze equipment casualties**
Knowledge you should have to perform this skill:	• Recognize the working parts of machining equipment • Identify and describe the components and working parts of machining equipment
References you should study to gain the knowledge you need to perform this skill:	• Machinery Repairman, chapters 4 through 11 and 15, NAVEDTRA 12204-A • Manufacturer's operating and technical manual
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about various machining equipment failures and their causes

Part 3

Advancement Handbook for MR1

General MR1 S*kill Area*	**TECHNICAL ADMINISTRATION**
A *skill* you are expected to perform from the General Skill Area above:	**Develop procedures for repair work**
Knowledge you should have to perform this skill:	• Recall the types of formal work procedures. • Recall the procedures for preparing formal work packages • Recall the general format and content of a formal work procedure • Recall the procedures for making changes to a formal work package
References you should study to gain the knowledge you need to perform this skill:	• Joint Fleet Maintenance Manual, Part 1, chapter 1, CINCLANTFLT/ INCPACFLTINST 4790.3
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the procedures in preparing and making changes, and the types, content and format of a formal work procedure.

General MR1 *Skill Area*	**QUALITY ASSURANCE**
A *skill* you are expected to perform from the General Skill Area above:	**Conduct QA inspections**
Knowledge you should have to perform this skill:	• Recall the requirements or the in-process control of a controlled and formal work package. • Recall the requirements, procedures, and criteria for conducting QA audits and surveillance.
References you should study to gain the knowledge you need to perform this skill:	• Joint Fleet Maintenance Manual, Part 1, chapter 4; Part II, chapter 8, CINCLANTFLT/CINCPACFLTINST 4790.3
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the in-process control of a controlled and formal work package. You can also expect questions about the requirements, procedures, and criteria for conducting QA audits and surveillance.

Part 4

Advancement Handbook for MRC

General MRC *Skill Area*	**QUALITY ASSURANCE**
A *skill* you are expected to perform from the General Skill Area above:	**Monitor QA programs for compliance**
Knowledge you should have to perform this skill:	• Recall the procedures for review of formal and controlled work packages • Recall the procedures for analyzing the root causes and actions taken for any discrepancies and non compliance of a controlled repair work
References you should study to gain the knowledge you need to perform this skill:	• Joint Fleet Maintenance Manual, Part 1, chapter 4; Part II, chapter 8, CINCLANTFLT/CINCPACFLTINST 4790.3
Exam Expectations. These are subject areas you should know to help you answer exam questions correctly:	You can expect questions about the requirements in reviewing work packages including QA forms. You can also expect questions about discrepancies encountered during in-process surveillance.

Appendix 1

References Used in This Advancement Handbook

Rating	Short Title	Long Title	Chapters/ Paragraphs	Stocking Point
MR3	NAVEDTRA 12014	Blueprint Reading and Sketching	Chapters 1 through 4	Note 1
	NAVEDTRA 12204-A	Machinery Repairman	Chapters 1 through 7, 9, and 13	Note 1
		Machinery's Handbook	Standards for Drawings	Note 5
		Machinery's Handbook	Standard Steels	Note 5
		Machinery's Handbook	Nonferrous Alloys	Note 5
		Machinery's Handbook	Plastics	Note 5
		Machinery's Handbook	Cutting Tools	Note 5
		Machinery's Handbook	Carbide Tips and Tools	Note 5
		Machinery's Handbook	Cemented Carbides and other Hard Materials	Note 5
		Machinery's Handbook	Hard Metal cutting Inserts	Note 5
		Machinery's Handbook	Measuring Instruments and Inspection Methods	Note 5
	NAVEDTRA 10069-D1	Mathematics, volume 1	Chapters 1 through 9, 13, and 17 through 19	Note 1
	NAVEDTRA 12085	Use and Care of Hand Tools and Measuring Tools	Chapters 2, 5, through 9, 12 through 16, l9, 20, 21, 24 through 29, 35, 38, 39, 41, and 52	Note 1
	S9086-RH-STM-010,	NSTM, Pumps	Chapter 503, pages 2-34 through 2-37, 3-19, 4-18 through 4-19	Note 1
	NAVSEA S9520-AA-MMA-01-0	Repair of Submarine Seawater Ball Valves (Non-Nuclear)	Volume 1, Appendices A, B, and C	Note 1
	Portsmouth Process Instruction Number, 4820-921-339	Repair of Seawater Valves, Seat Cavities and O-ring Areas	Sections 1, 2, and 3	Note 6
	NAVSEA S6225-AP-MMI-010	Centrifugal Pump	Chapters 9 and 14	Note 1
	NAVSEA S9253-AD-MMM-010	Valves, Traps, and Orifices (Non-Nuclear)	Pages 6-20 through 6-28, 6-57, 6-66 through 6-71	Note 1
	CINCLANTFLT/ CINCPACFLTINST 4790.3	Joint Fleet Maintenance Manual, volume 4,	Part 1, Chapter 22	Note 2

	CINCANTFLT/ CINCPACFLTINST 4790.3	Joint Fleet Maintenance Manual, volume 5	Part 1, chapter 1; Part 11, chapters 1 through 5, and 7	Note 2
	NAVSHIPS 0900-LP-038-8010	Metal Comparison Guide	All	Note 1
	OPNAVINST 4790.4	Ships'Maintenance and Material Management (3-M) Manual	Chapter 3	Note 4
		Ship's Drawing Index (ship specific)		Note 7
MR2		Machinery's Handbook	Simple, Compound, Differential, and Block Indexing;	Note 5
		Machinery's Handbook	Gears and Gearing	Note 5
		Machinery's Handbook	Testing the Hardness of Metal	Note 5
		Machinery's Handbook	Plastics	Note 5
		Machinery's Handbook	Standard Steels	Note 5
		Machinery's Handbook	Heat Treatment of Standard Steel;	Note 5
		Machinery's Handbook	Non-ferrous Alloys	Note 5
		Machinery's Handbook	Heat Treatment of Non-ferrous Alloys	Note 5
		Machinery's Handbook	Numbering system	Note 5
		Machinery's Handbook	Surface Texture	Note 5
	NAVEDTRA 12014	Blueprint Reading and Sketching	Chapters 1 through 4	Note 1
	NAVEDTRA 10069-D1	Mathematics, Vol. 1	Chapters 4 and 5	Note 1
	MIL-STD-2197(SH)	Brush Electroplating on Marine Machinery	All	Note 3
	MIL-STD-1687(SH)	Thermal Spray Processes for Naval Ship Machinery Application	All	Note 3
	NAVSEA S9520-AA-MMA-01-0	Repair of Submarine Seawater Ball Valves (Non-Nuclear)	Volume 1, chapter 3, Appendix D	Note 1
	NAVSEA S9253-AD-MMM-010	Maintenance Manual for Valves, Traps, and Orifices (Non-Nuclear)	Volume 1, chapter 6	Note 1
	NAVSHIPS 0900-LP-038-8010	Ship Metallic Material Comparison and Use Guide	All	Note 1
	CINCLANTFLT/ CINCPACFLTINST 4790.3	Joint Fleet Maintenance Manual	Volume V, Part 11, chapters 5, 8, and 11	Note 2
	NAVSEA S9086-RH-STM-10	NSTM, Pumps	Chapter 503, Sections 1 through 6	Note 1
	NAVSEA S6225-AP-MM1-010	Description and Repair of Centrifugal Pumps	Chapters 9, 14	Note 1
	NAVSEA ST700-AM-GYD-010/METCAL,	Metrology and Calibration Laboratory Requirements and Certification Guide	Chapter 6	Note 1
	MIL-STD-1839	Calibration and Measurements Requirements,	All	Note 3

MR1	CINCLANTFLT/CINCPACFLTINST 4790.3	Joint Fleet Maintenance Manual	Part 1, Chaps 1 and 4 Part II, Chapter 8	Note 2
MRC	CINCLANTFLT/CINCPACFLTINST 4790.3	Joint Fleet Maintenance Manual	Volume V, Part 1, chapter 4; Part II, chapter 8	Note 2

LEGEND:

Note 1– To order, MILSTRIP to Naval Inventory Control Point (NAVICP), Code 334 700 Robbins Ave. Philadelphia, PA 19111-5098, or via INTERNET http://www.nll.navsup.navy.mil
Note 2– INTERNET - http://www.submepp.navy.mil/corrres.htm
Note 3– INTERNET - http://dossp.daps.mil or DOD Index of Specifications and Standards Part 11 (Use form DAPS Phila 1425E
Note 4– INTERNET - http://neds.nebt.daps.mil/
Note 5– Commercial purchase
Note 6– Send Letter of Request to Portsmouth Naval Shipyard using book title and number
Note 7– Can be found on the ship's technical library